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(54) MANUAL WELDING METHODS FOR PROVIDING TO A MANUAL WELDING APPARATUS AN AUTOMATIC WIRE RETRACT METHOD

HANDSCHWEISSVERFAHREN FÜR EINE HANDSCHWEISSVORRICHTUNG FÜR AUTOMATISCHEN DRAHTEINZUG

PROCÉDÉS DE SOUDAGE MANUEL MIS EN OEUVRE AVEC UN APPAREIL DE SOUDAGE MANUEL POUR RÉALISER UNE RÉTRACTION AUTOMATIQUE DU FIL

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Description

[0001] The invention described herein relates generally to an automatic wire retract method for a manual welding apparatus according to the preamble of claim 1 (see, for example, US 2008/0149608 A). Additionally, the invention relates to retrofitting or modifying a manual welding apparatus to include an automatic wire retract method, this according to the preamble of claim 7 or claim 9.

Technical Background

[0002] Manual welding apparatuses are configured to be operated by welders and other personnel. Often, manual welding apparatuses include welding wire feeders that advance welding wire to a welding gun when a welder activates a welding gun trigger. After welding, a pointed end of the welding wire extends from the welding gun, possibly exposing welders and other personnel to a potentially unsafe condition.

Summary of the invention

[0003] In view of the foregoing problems and shortcomings of existing manual welding apparatuses, the present application describes a manual welding apparatus using a method to overcome these shortcomings.

[0004] The problem is solved by methods according to the claims 1, 7 and 9. Particularly preferred embodiments may be taken from the sub claims.

[0005] Within the scope of the invention (see claim 1) is an automatic wire retract method of providing a manual welding apparatus having at least a welding power source, a wire feeder configured to supply a welding wire, and a welding gun having a trigger and an opening from which the welding wire extends. The method includes an automatic wire retract program having a retract delay time. The manual welding apparatus is configured to include the automatic wire retract program. The program monitors when the trigger is enabled to extend the welding wire from the wire feeder to the opening and extends the welding wire out of the opening of the welding gun. The program also determines a first amount of time when the trigger is disabled. Further, the program determines when the first amount of time is at least equal to the retract delay time when the trigger is disabled during the first amount of time. The program then retracts the welding wire into the opening of the welding gun such that the welding wire does not extend from the opening of the welding gun. Preferably the manual welding apparatus further comprises a welding gas supply configured to shield a weld made by the manual welding apparatus.

[0006] Within the scope of the invention (see claim 7) is a method of locating a manual welding apparatus that does not have an automatic wire retract program and means for modifying the manual welding apparatus so that the automatic wire retract program is enabled.

[0007] These and other objects of this invention will be evident when viewed in light of the drawings, detailed description and appended claims.

Brief Description of the Drawings

[0008] The invention may take physical form in certain parts and arrangements of parts, a preferred embodiment of which will be described in detail in the specification and illustrated in the accompanying drawings which form a part hereof, and wherein:

Fig. 1 is a perspective view of a manual welding apparatus;

Fig. 2 is a side view of a welding gun of *Fig. 1*;

Figs. 3a-3c are enlarged cross sectional views through the nozzle of *Fig. 2;*

Figs. 4a-4c are enlarged cross sectional views of another nozzle embodiment;

Figs. 5a-5c are enlarged cross sectional views of yet another nozzle embodiment;

Figs. 6a-6c are side views of a tip of an alternative welding gun;

Fig. 7 is a flow chart illustrating one embodiment of an automatic wire retract method; and

Fig. 8 is a flow chart illustrating a method for modifying a manual welding apparatus.

Detailed Description

[0009] The best mode for carrying out the invention will now be described for the purposes of illustrating the best mode known to the applicant at the time of the filing of this patent application. The examples and figures are illustrative only and not meant to limit the invention, which is measured by the scope and spirit of the claims.

[0010] Referring now to the drawings wherein the showings are for purposes of illustrating the preferred embodiment of the invention only and not for purposes of limiting the same, as illustrated in *Fig.* 1, manual welding apparatus 100 includes welding power source 102, wire feeder 104, and gas supply 106. Welding power source 102 includes power cables 108, control cable 110, and power supply cable (not shown). Power cables 108 include a ground wire and clamp 112 connected to a work piece and power cable 114 configured to connect to wire feeder 104. Control cable 110 may be configured to connect to the wire feeder 104. In another embodiment (not shown), control cable 110 may be configured to be wireless. It is understood that welding power source 102, power cables 108, and control cable 110 can have any

configuration suitable for supplying power and welding controls to the manual welding apparatus 100.

[0011] Further illustrated in *Fig.* 1, pipe 116 and regulator 118 are configured to connect gas supply 106 to wire feeder 104. Gas supply 106 may include inert gases, active gases, or a combination of both, including but not limited to argon, helium, carbon dioxide, argon and helium, argon and hydrogen, and other gas combinations. In another embodiment (not shown), the manual welding apparatus 100 uses welding wire that is coated with a material that forms a gas shield when burned, therefore, a gas supply may not be included in manual welding apparatus 100. It is understood that the gas supply may be any gas or combination of gases configured to shield a weld from the atmosphere.

[0012] As shown in *Fig.* 1, wire feeder 104 may include housing 120, gear box 122, wire spool assembly 124, and user interface 126. Extending from gear box 122 is hose 128 that is configured to connect to welding gun 130. Housing 120 may be connected to the user interface 126 and gear box 122. Further, control cable 110 and power cable 114 extending from welding power source 102 and pipe 116 extending from gas supply 106 are configured to connect to housing 120, gear box 122, and hose 128. Gear box 122 includes at least a plurality of rollers (not shown) that advance and retract the welding wire (not shown) and a wire guide (not shown) that controls the welding wire. It is understood that wire feeder 104 may have any configuration suitable for receiving a gas supply, a power supply, and welding controls.

[0013] Extending between gear box 122 and welding gun 130 is hose 128 that may contain the welding wire and wire conduit, a gas line, and a welding gun trigger switch connection. In another embodiment (not shown), as discussed above, hose 128 does not include a gas line. In yet another embodiment (not shown), hose 128 may include a control cable configured to connect welding gun 130 to at least one of the following: welding power source 102, wire feeder 104, and gas supply 106. Hose 128 can be any diameter and length configured to contain the welding wire, the gas hose, and the switch connection. Hose 128 is made of any material suitable for welding environments. It is understood that hose 128 and welding gun 130 may have any configuration suitable for supplying welding wire, welding gas, and controls through the hose and to the welding gun.

[0014] In the illustrated embodiment of manual welding apparatus 100, user interface 126 includes at least one of the following: a control system, a computer, a software program, and a setup program. For example, user interface 126 on manual welding apparatus 100 may include an automatic wire retract program configured to reverse gear box 122 on wire feeder 104 so exposed welding wire (not shown) retracts from an opening or an end of the welding gun. The automatic wire retract program is designed to prevent a welder from being exposed to a potentially sharp end of the welding wire that may stick out or extend beyond the opening or the end of welding gun 130. The automatic wire retract program can be password protected so that supervisors and other management personnel can maintain control of the automatic wire retract program.

[0015] In one embodiment of the automatic wire retract program, a welder discontinues use of the manual welding apparatus 100 for more than a first amount of time and the automatic wire retract program is configured to retract the welding wire from the opening or the end of the welding gun for a second amount of time. For example, user interface 126 may include a first setting where a retract delay time is set and a second setting where a retract time is set. After these settings are made, if a welder discontinues use of the apparatus for an amount of time greater than the specified first amount of time, then the wire feeder retracts the welding wire for the second amount of time.

[0016] In another embodiment, the automatic wire retract program is configured to retract the welding wire from the opening or the end of the welding gun for a predetermined distance when a welder discontinues use of the manual welding apparatus **100** for more than a first amount of time. For example, user interface 126 may include a first setting where a retract delay time is set and a second setting where a retract distance is set.

[0017] In yet another embodiment, upon a welder discontinuing use of manual welding apparatus 100 for more than a first amount of time, the automatic wire retract program is configured to retract the welding wire from the opening or the end of the welding gun until a sensor system (not shown) indicates that the end of the welding wire is in a safe zone (not shown) within welding gun 130. For example, automatic wire retract program may retract the welding wire until the sensor is activated, wherein the sensor indicates that the end of the welding wire is contained within the nozzle, the tip (not shown), or both the nozzle and tip. Automatic wire retract methods for manual welding apparatuses will be further discussed below. It is understood that the user interface and the automatic wire retract program may be configured in any way so that the end of the welding wire in a manual welding apparatus retracts into a portion of the welding gun, e.g., a tip and a nozzle, so a welder is not exposed to a potentially sharp welding wire.

[0018] As shown in *Fig.* 2, hose **128** is configured to connect to a welding gun **130** in proximity to a welding gun handle **132.** Trigger **134** on handle **132** is configured to advance welding wire **136** from the gear box of the wire feeder (not shown) through hose 128 and handle 132, and further along neck 138 and nozzle 140. Nozzle 140 is configured to removably attach to neck 138. In addition, trigger 134 may be configured to control welding shielding gas. For example, welding wire 136 extends from nozzle **140** and welding shielding gas surrounds welding wire when a welder actuates trigger 134. In another embodiment (not shown), neck 138 may have a longer or shorter length and may bend at a different angle than what is shown in *Fig. 2.* It is understood that welding

gun 130 may have any configuration suitable for a welder to control the advancement of the welding wire and the supply of the welding shielding gas.

[0019] Further illustrated in *Fig.* 2 is a cross-section of nozzle 140 which may include insulating boss 142 that is configured to prevent heat from transferring from nozzle 140 to at least one of the following: neck 138 and welding gun handle 132. Inside nozzle 140, tip 144 is configured to removably attach to neck 138. Tip 144 is further configured to guide welding wire 136 along a center of nozzle 140 and to allow welding gas to emit from gas passages 146 to shield welding wire 136 from the surrounding environment. In another embodiment (not shown), the welding gun includes handle 132, trigger 134, neck 138, tip 144, and gas passages 146; welding gun 130 may not include nozzle 140. It is understood that the nozzle 140 may have any configuration suitable for a welder to control the welding wire and the supply of a welding shielding gas.

[0020] *Figs. 3a-3c are* enlarged cross-sectional views of nozzle 140 of *Fig.* 2 where tip 144 is configured to be within end 140a of nozzle 140. The series of *Figs 3a-3c* illustrate an example of how manual welding apparatus 100 is configured to operate when using the automatic wire retract program. For purposes of this example, *Fig.* 3a shows a cross-section of the nozzle 140 for an initial welding condition before a welder uses the manual welding apparatus 100. *Fig.* 3a shows nozzle 140 having welding wire 136 extending from tip 144, wherein welding wire 136 and tip 144 are completely within end 140a of nozzle 140. *Fig. 3b* shows a nozzle cross-section after a welder uses manual welding apparatus **100.** As shown in *Fig. 3b,* welding wire 136 extends beyond end 140a of nozzle 140, potentially exposing the welder to an end of the welding wire **136.** By enabling the automatic wire retract program through the user interface **126,** manual welding apparatus **100** is configured to automatically retract the end of welding wire **136** within end **140a** of nozzle **140** when a welder stops weiding for a specified amount of time, as illustrated in *Fig. 3c.* For example, if a welder stops welding for 20 seconds, the automatic wire retract program would retract the welding wire so it is not exposed to the welder. In another embodiment (not shown), the nozzle and tip can be longer or shorter than what is illustrated in *Figs. 3a-3c.* It is understood that a manual welding apparatus **100** may be configured with the automatic wire retract program so that the welding wire retracts at least within the end 140a of the nozzle **140** when a welder stops welding for a specified amount of time. The times mentioned above are for illustrative purposes only and both larger and shorter periods of time are within the scope of this invention.

[0021] *Figs. 4a-4c are enlarged* cross-sectional views of nozzle **140** of *Fig.* 2 where tip **144** is configured to extend past end **140a** of nozzle **140.** Similar to the series of *Figs 3a-3c* above, the series of *Figs 4a-4c* illustrate an example of how manual welding apparatus **100** is configured to operate when using the automatic wire retract program. Again, for purposes of this example, *Fig.* 4a shows a cross section of nozzle **140** for an initial welding condition before a welder uses the manual welding apparatus **100.** *Fig. 4a* shows nozzle **140** and tip **144,** wherein welding wire is not extending from tip **144** and tip **144** extends past end **140a** of nozzle **140.** *Fig. 4b* shows a nozzle cross-section after a welder uses the manual welding apparatus **100.** As shown in *Fig. 4b,* welding wire **136** extends from the end of tip **144,** potentially exposing the welder to an end of welding wire **136.** By enabling the automatic wire retract program through user interface **126,** manual welding apparatus **100** is configured to automatically retract the end of welding wire **136** within the end of tip **144** when a welder stops welding for a specified amount of time, as illustrated in *Fig. 4c.* In another embodiment (not shown), the tip can be longer or shorter than what is illustrated in *Figs. 4a-4c.*

[0022] *Figs. 5a-5c are* enlarged cross-sectional views of another embodiment of nozzle **140** of *Fig.* 2 where tip **144** is configured to be within end **140a** of nozzle **140.** Further, the nozzle includes at least one sensor **148** configured to indicate location of weiding wire **136.** The at least one sensor can include at least one of the following proximity sensors: mechanical, electrical, optical, laser, ultrasonic, and the like. The series of *Figs 5a-5c* illustrate an example of how a manual welding apparatus **100** is configured to operate when using the automatic wire retract program with at least one sensor. *Fig.* 5a shows a cross section of nozzle **140** for an initial welding condition before a welder uses the manual welding apparatus **100.** *Fig.* 5a shows nozzle **140** and tip **144,** wherein welding wire is not extending from tip **144** and the at least one sensor **148** does not sense welding wire **136.** *Fig. 5b* shows a nozzle cross-section after a welder uses manual welding apparatus **100.** As shown in *Fig. 5b,* welding wire **136** extends beyond the end of nozzle **140** and tip **144,** potentially exposing the welder to an end of welding wire **136.** By enabling the automatic wire retract program through user interface **126,** manual welding apparatus **100** is configured to automatically retract the end of welding wire **136** within end **140a** of nozzle **140** when a welder stops welding. The welding wire will retract until the welding wire activates the at least one sensor **148** indicating that the end of the welding wire is within nozzle **140** or within tip **144,** as illustrated in *Fig. 5c.* In another embodiment (not shown), the tip can be longer or shorter than what is illustrated in *Figs. 5a-5c.* In yet another embodiment (not shown), the number of sensors **148** can be a number less than or greater than the number illustrated in *Figs. 5a-5c.*

[0023] *Figs. 6a-6c* are side views of tip **144** of an alternative welding gun where welding gun (not shown) does not include a nozzle so the entire tip **144** is exposed. The series of *Figs 6a-6c* illustrate an example of how a manual welding apparatus **100** is configured to operate when using the automatic wire retract program. *Fig.* 6a shows a side view of tip **144** for an initial welding condition before a welder uses manual welding apparatus **100.** *Fig.* 6a

shows where the welding wire is not extending from exposed tip **144.** *Fig. 6b* shows the side view of tip **144** after a welder uses manual welding apparatus **100.** As shown in *Fig. 6b,* welding wire **136** extends from the end of tip **144,** potentially exposing the welder to an end of welding wire **136.** By enabling the automatic wire retract program through user interface **126,** manual welding apparatus **100** is configured to automatically retract the end of welding wire **136** within the end of tip **144** when a welder stops welding for a specified amount of time, as illustrated in *Fig. 6c.* In another embodiment (not shown), the tip can be longer or shorter than what is illustrated in *Figs. 6a-6c.*

[0024] *Fig.* 7 is a flow chart illustrating one embodiment of an automatic wire retract method **700** for manual welding apparatus **100.** As shown in *Fig.* 7, a manual welding apparatus is configured to power up at **702.** At **704,** a computer having an automatic wire retract program determines whether a user is attempting to access the setup menu through the user interface or computer. If the user is attempting to access the setup menu at **704,** the computer determines if the setup menu is locked at optional **706.** If the setup menu is locked at optional **706,** the computer determines if the user enters the correct password at **708.** If the setup menu is locked and the user does not enter the correct password, the computer blocks access to the setup parameters and returns the user to a previous user interface option at **710.** If the setup menu is locked and the user does enter the correct password, the computer allows the user access to the setup parameters to enable or disable the automatic wire retract program at **712.** After the user enables or disables the automatic wire retract program and any related parameters, the computer returns the user to a previous user interface option at **714.** For example, the user may adjust at least one of the following parameters, including: a retract delay time, a retract time, a retract distance, and proximity sensor parameters.

[0025] If the user is not attempting to access the setup menu at **704,** the computer determines if the welding gun trigger is enabled at **716.** If the welding gun trigger is not enabled and the manual welding apparatus has power, the computer waits until the welding gun trigger is enabled or the user attempts to access the setup menu at **718.** If the welding gun trigger is enabled at **716,** the wire feeder starts and the welding power source supplies power at **720.** At **722,** the computer determines if the welding gun trigger is disabled. If the welding gun trigger is not disabled, the computer monitors the welding gun trigger at **724.** When the welding gun trigger is disabled at **722,** the computer determines if the welding arc is extinguished at 726. If the welding arc is not extinguished at **726,** the computer monitors the welding arc at **728.**

[0026] When the welding arc is extinguished at **726,** the computer tracks a wait time delay and determines if the wait time delay is greater than a retract delay time set in the user interface at **730.** For example, the retract delay time can be any time greater than zero. If the wait time delay is less than the retract delay time set in the user interface, the computer continues to monitor the wait time delay. If the wait time delay is at least equal to the retract delay time set in the user interface, the computer checks to see that the welding gun trigger is enabled at **732.** If the welding gun trigger is enabled at **732,** the wire feeder starts and the welding power source supplies power at **720.** If the welding gun trigger is not enabled at **732** and the wait time delay is at least equal to the retract delay time set in the user interface, the automatic wire retract program retracts the welding wire based on user interface parameters at **734.** For example, the welding wire may retract for an amount of time or a specific distance. At **736,** the computer determines if the welding gun trigger is enabled. If the welding gun trigger is enabled at **736,** the wire feeder starts and the welding power source supplies power at **720.** If the welding gun trigger is not enabled at **736,** at **738** the computer returns to the beginning of the method at **704.**

[0027] In another embodiment of the method, the computer monitors the gear box drive motor on the wire feeder for excess current or torque, wherein the excess current or torque may indicate a problem with the automatic wire retract method. In any case, it must be understood that manual welding apparatus **100** using automatic wire retract method **700** may be configured so that the welding wire retracts at least within end **140a** of nozzle **140** or tip **144** when a welder stops welding for a specified amount of time.

[0028] In yet another embodiment (not shown) of an automatic wire retract method **700** for manual welding apparatus **100,** method **700** includes at least one of the following method steps. If a welding gun trigger is enabled, a wire feeder starts and a welding power source supplies power. A computer is configured to determine if the welding gun trigger is disabled. If the welding gun trigger is not disabled, the computer monitors the welding gun trigger. Alternatively, when the welding gun trigger is disabled, the computer determines if a welding arc is extinguished. If the welding arc is not extinguished, the computer monitors the welding arc. Once the welding arc is extinguished, the computer is configured to track a wait time delay and determine if the wait time delay is greater than a retract delay time set in the user interface. If the wait time delay is less than the retract delay time set in the user interface, the computer continues to count the wait time delay. If the wait time delay is at least equal to the retract delay time set in the user interface, the computer checks to see that the welding gun trigger is enabled. If the welding gun trigger is enabled, the wire feeder starts and the welding power source supplies power. If the welding gun trigger is not enabled and the wait time delay is at least equal to the retract delay time set in the user interface, the automatic wire retract program retracts the welding wire.

[0029] *Fig.* 8 is a flow chart illustrating one embodiment of an automatic wire retract method for a retrofit or modification of a manual welding apparatus. As shown in *Fig. 8,* a manual welding apparatus is located that does not

have an automatic wire retract program at **802.** At **804,** a manual welding apparatus that has once been manufactured or sold is retrofit or modified with an automatic wire retract program. For example, at least one of the following is added to or modified in the manual welding apparatus, including: a software program, hardware, a relay, a printed circuit board, a wire harness, a user interface, and the like.

[0030] A computer or user interface **126** that may include a computer having an automatic wire retract program illustrates one possible hardware configuration to support the systems and methods described herein, including the methods **700** and **800** above. In order to provide additional context for various aspects of the present invention, the following discussion is intended to provide a brief, general description of a suitable computing environment in which the various aspects of the present invention may be implemented. Those skilled in the art will recognize that the invention also may be implemented in combination with other program modules and/or as a combination of hardware and software. Generally, program modules include routines, programs, components, data structures, etc., that perform particular tasks or implement particular abstract data types.

[0031] Moreover, those skilled in the art will appreciate that the inventive methods may be practiced with other computer system configurations, including single-processor or multiprocessor computer systems, minicomputers, mainframe computers, as well as personal computers, hand-held computing devices, microprocessor-based or programmable consumer electronics, and the like, each of which may be operatively coupled to one or more associated devices. The illustrated aspects of the invention may also be practiced in distributed computing environments where certain tasks are performed by remote processing devices that are linked through a communications network. In a distributed computing environment, program modules may be located in both local and remote memory storage devices.

[0032] The computer or the user interface 126 that may include a computer having an automatic wire retract program can utilize an exemplary environment for implementing various aspects of the invention including a computer, wherein the computer includes a processing unit, a system memory and a system bus. The system bus couples system components including, but not limited to the system memory to the processing unit. The processing unit may be any of various commercially available processors. Dual microprocessors and other multi-processor architectures also can be employed as the processing unit.

[0033] The system bus can be any of several types of bus structure including a memory bus or memory controller, a peripheral bus and a local bus using any of a variety of commercially available bus architectures. The system memory can include read only memory (ROM) and random access memory (RAM). A basic input/output system (BIOS), containing the basic routines that help to transfer information between elements within the computer, such as during start-up, is stored in the ROM.

[0034] The computer or the user interface **126** that may include a computer having an automatic wire retract program can further include a hard disk drive, a magnetic disk drive, e.g., to read from or write to a removable disk, and an optical disk drive, e.g., for reading a CD-ROM disk or to read from or write to other optical media. The computer or the user interface 126 that may include a computer having an automatic wire retract program can include at least some form of computer readable media. Computer readable media can be any available media that can be accessed by the computer. By way of example, and not limitation, computer readable media may comprise computer storage media and communication media. Computer storage media includes volatile and nonvolatile, removable and non-removable media implemented in any method or technology for storage of information such as computer readable instructions, data structures, program modules or other data. Computer storage media includes, but is not limited to, RAM, ROM, EEPROM, flash memory or other memory technology, CD-ROM, digital versatile disks (DVD) or other magnetic storage devices, or any other medium which can be used to store the desired information and which can be accessed by the user interface 126.

[0035] Communication media typically embodies computer readable instructions, data structures, program modules or other data in a modulated data signal such as a carrier wave or other transport mechanism and includes any information delivery media. The term "modulated data signal" means a signal that has one or more of its characteristics set or changed in such a manner as to encode information in the signal. By way of example, and not limitation, communication media includes wired media such as a wired network or direct-wired connection, and wireless media such as acoustic, RF, infrared and other wireless media. Combinations of any of the above should also be included within the scope of computer readable media.

[0036] A number of program modules may be stored in the drives and RAM, including an operating system, one or more application programs, other program modules, and program data. The operating system in the computer or the user interface **126** can be any of a number of commercially available operating systems.

[0037] In addition, a user may enter commands and information into the computer through a keyboard and a pointing device, such as a mouse. Other input devices may include a microphone, an IR remote control, a track ball, a pen input device, a joystick, a game pad, a digitizing tablet, a satellite dish, a scanner, or the like. These and other input devices are often connected to the processing unit through a serial port interface that is coupled to the system bus, but may be connected by other interfaces, such as a parallel port, a game port, a universal serial bus ("USB"), an IR interface, and/or various wireless technologies. A monitor or other type of display

device, may also be connected to the system bus via an interface, such as a video adapter. Visual output may also be accomplished through a remote display network protocol such as Remote Desktop Protocol, VNC, X-Window System, etc. In addition to visual output, a computer typically includes other peripheral output devices, such as speakers, printers, etc.

[0038] A display can be employed with user interface 126 to present data that is electronically received from the processing unit. For example, the display can be an LCD, plasma, CRT, etc. monitor that presents data electronically. Alternatively or in addition, the display can present received data in a hard copy format such as a printer, facsimile, plotter etc. The display can present data in any color and can receive data from the user interface 126 via any wireless or hard wire protocol and/or standard.

[0039] The computer can operate in a networked environment using logical and/or physical connections to one or more remote computers, such as a remote computer(s). The remote computer(s) can be a workstation, a server computer, a router, a personal computer, microprocessor based entertainment appliance, a peer device or other common network node, and typically includes many or all of the elements described relative to the computer. The logical connections depicted include a local area network (LAN) and a wide area network (WAN). Such networking environments are commonplace in offices, enterprise-wide computer networks, intranets and the Internet.

[0040] When used in a LAN networking environment, the computer is connected to the local network through a network interface or adapter. When used in a WAN networking environment, the computer typically includes a modem, or is connected to a communications server on the LAN, or has other means for establishing communications over the WAN, such as the Internet. In a networked environment, program modules depicted relative to the computer, or portions thereof, may be stored in the remote memory storage device. It will be appreciated that network connections described herein are exemplary and other means of establishing a communications link between the computers may be used.

[0041] While the invention has been described with reference to certain embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from its scope. Therefore, it is intended that the invention not be limited to the particular embodiments disclosed, but that the invention will include all embodiments falling within the scope of the appended claims.

Reference numbers

100	welding apparatus	148	sensor
102	power source	700	method
104	wire feeder	702	step
106	gas supply	704	step/position
108	power cable	706	step/position
110	control cable	708	step/position
112	clamp	710	step/position
114	power cable	712	step/position
116	pipe	714	step/position
118	regulator	716	step/position
120	housing	718	step/position
122	gearbox	720	step/position
124	wire spool assembly	722	step/position
126	user interface	724	step/position
128	hose	726	step/position
130	welding gun	728	step/position
132	handle	730	step/position
134	trigger	732	step/position
136	welding wire	734	step/position
138	neck	736	step/position
140	nozzle	738	step/position
140a	end	800	method
142	boss	802	step/position
144	tip	804	step/position
146	gas passages		

Claims

1. An automatic wire retract method for a manual welding apparatus comprising:

providing a manual welding apparatus (100) having at least a welding power source (102), a wire feeder (104) configured to supply a welding wire (136), and a welding gun (130) having a trigger (134) and an opening from which the welding wire (136) extends;
providing an automatic wire retract program having a retract delay time;
configuring the manual welding apparatus (100) to include the automatic wire retract program;
monitoring when the trigger (134) is enabled to extend the welding wire (136) from the wire feeder (104) to the opening, and extending the welding wire (136) out of the opening of the welding gun (120);
determining a first amount of time when the trigger (134) is disabled;
determining when the first amount of time is at least equal to the retract delay time, wherein the trigger (134) is disabled during the first amount of time; and
retracting the welding wire (136) into the opening of the welding gun (130) such that the welding

wire (136) does not extend from the opening of the welding gun (130).

2. The method of claim 1, wherein the retracting the welding wire (136) into the opening of the welding gun (130) is configured to retract for a retract time; wherein the retract time is configured in the automatic wire retract program.

3. The method of claim 1, wherein the retracting the welding wire (136) into the opening of the welding gun (130) is configured to retract for a retract distance; wherein the retract distance is configured in the automatic wire retract program.

4. The method of any of the claims 1 to 3, wherein the welding gun (130) further comprises at least one sensor (148) configured to indicate an end of the welding wire (136), wherein a sensor parameter and the retracting step are configured to determine when the retracting step is complete.

5. The method of any of the claims 1 to 4, wherein the wire feeder (104) further comprises a user interface (136) configured to set the retract delay time and at least one of the following: a retract time, a retract distance, and a sensor parameter.

6. The method of any of the claims 1 to 5, wherein the automatic wire retract program is configured to include a password program to enable adjustment of at least one of the following: the retract delay time, a retract time, a retract distance, and a sensor parameter.

7. A method comprising:

locating a manual welding apparatus (100) having a welding gun (130) and an opening, that does not include an automatic wire retract program, by which a welding wive (136) does not extend from the opening of the welding gun (130)
modifying the manual welding apparatus (100) so that it includes the automatic wire retract program; and
enabling the automatic wire retract program.

8. The method of claim 7, further comprising means for retracting a welding wire.

9. A method comprising:

providing a manual welding apparatus (100) configured to supply a welding wire (136) to a welding gun (130), wherein the welding gun (130) has a trigger (134) and an opening where the welding wire (136) extends when the trigger (134) is activated;
providing a computer with a user interface (126) that includes an automatic wire retract program by which a welding wive (136) does not extend from the opening of the welding gun (130);
monitoring the welding gun (130);
determining when the trigger (134) is disabled;
configuring the automatic wire retract program to indicate when a first condition is satisfied; and
retracting the welding wire (134) such that the welding wire (134) does not extend from the opening of the welding gun (130).

10. The method of claim 9, wherein the first condition is a retract delay time.

11. The method of any of the claims 7 to 10 , further comprising means for determining a first amount of time when the trigger (134) is disabled or including determining a first amount of time when the trigger (134) is disabled, and further determining when the first amount of time is at least equal to the retract delay time.

12. The method of any of the claims 7 to 11, further comprises configuring the user interface (126) to include the retract delay time and a retract time or a retract distance.

13. The method of any of the claims 7 to 12, further comprising at least one sensor (148) and configuring the user interface (126) to include the retract delay time and a sensor parameter, wherein the at least one sensor (148) is configured to indicate an end of the welding wire, wherein the sensor parameter and the retracting step are configured to indicate when to stop the retracting step.

14. The method of any of the claims 1 to 13, wherein the opening of the welding gun (130) comprises a nozzle (140) having a nozzle end (140a) and a tip (144), wherein the welding wire (136) retracts inside the tip (144) by the end of the retracting step or wherein the welding wire (136) does not extend past the nozzle end (140a) by the end (144) of the retracting step.

15. The method of any of the claims 1 to 14, wherein the opening of the welding gun (130) comprises a tip (144), wherein the welding wire (136) retracts inside the tip (144) by the end of the retracting step, or wherein the welding wire does not extend past the tip by the end of the retracting step.

Patentansprüche

1. Automatisches Drahtrückziehverfahren für ein Handschweißgerät, das Folgendes umfasst:

Bereitstellen eines Handschweißgerätes (100) mit mindestens einer Schweißstromquelle (102), einer Drahtzuführvorrichtung (104), die dafür konfiguriert ist, einen Schweißdraht (136) zuzuführen, und einem Schweißbrenner (130), der einen Auslöser (134) und eine Öffnung aufweist, aus der sich der Schweißdraht (136) erstreckt;

Bereitstellen eines automatischen Drahtrückziehprogramms, das eine Rückziehverzögerungszeit aufweist;

Konfigurieren des Handschweißgerätes (100) dergestalt, dass es das automatische Drahtrückziehprogramm enthält;

Überwachen, wenn der Auslöser (134) aktiviert wird, um den Schweißdraht (136) von der Drahtzuführvorrichtung (104) zu der Öffnung zu ziehen, und Ziehen des Schweißdrahtes (136) aus der Öffnung des Schweißbrenners (120);

Bestimmen eines ersten Zeitbetrages, wenn der Auslöser (134) deaktiviert wird;

Bestimmen, wann der erste Zeitbetrag mindestens gleich der Rückziehverzögerungszeit ist, wobei der Auslöser (134) während des ersten Zeitbetrages deaktiviert wird; und

Zurückziehen des Schweißdrahtes (136) in die Öffnung des Schweißbrenners (130), so dass der Schweißdraht (136) nicht aus der Öffnung des Schweißbrenners (130) hervorsteht.

2. Verfahren nach Anspruch 1, wobei das Zurückziehen des Schweißdrahtes (136) in die Öffnung des Schweißbrenners (130) dafür konfiguriert ist, für die Dauer einer Rückzugszeit zurückzuziehen; wobei die Rückzugszeit in dem automatischen Drahtrückziehprogramm konfiguriert ist.

3. Verfahren nach Anspruch 1, wobei das Zurückziehen des Schweißdrahtes (136) in die Öffnung des Schweißbrenners (130) dafür konfiguriert ist, um die Länge einer Rückzugsdistanz zurückzuziehen; wobei die Rückzugsdistanz in dem automatischen Drahtrückziehprogramm konfiguriert ist.

4. Verfahren nach einem der Ansprüche 1 bis 3, wobei der Schweißbrenner (130) des Weiteren mindestens einen Sensor (148) umfasst, der dafür konfiguriert ist, ein Ende des Schweißdrahtes (136) anzuzeigen, wobei ein Sensorparameter und der Rückzugsschritt dafür konfiguriert sind festzustellen, wenn der Rückzugsschritt vollendet ist.

5. Verfahren nach einem der Ansprüche 1 bis 4, wobei die Drahtzuführvorrichtung (104) des Weiteren eine Benutzerschnittstelle (136) umfasst, die dafür konfiguriert ist, die Rückziehverzögerungszeit und mindestens eines von Folgendem einzustellen: eine Rückzugszeit, eine Rückzugsdistanz und einen Sensorparameter.

6. Verfahren nach einem der Ansprüche 1 bis 5, wobei das automatische Drahtrückziehprogramm dafür konfiguriert ist, ein Passwortprogramm zu enthalten, um das Justieren von mindestens einem von Folgendem zu ermöglichen: der Rückziehverzögerungszeit, einer Rückzugszeit, einer Rückzugsdistanz und eines Sensorparameters.

7. Verfahren, das Folgendes umfasst:

Positionieren eines Handschweißgerätes (100), das einen Schweißbrenner (130) und eine Öffnung aufweist und das kein automatisches Drahtrückziehprogramm enthält, durch das sich kein Schweißdraht (136) aus der Öffnung des Schweißbrenners (130) erstreckt,

Modifizieren des Handschweißgerätes (100) dergestalt, dass es das automatische Drahtrückziehprogramm enthält; und

Aktivieren des automatischen Drahtrückziehprogramms.

8. Verfahren nach Anspruch 7, das des Weiteren ein Mittel zum Zurückziehen eines Schweißdrahtes umfasst.

9. Verfahren, das Folgendes umfasst:

Bereitstellen eines Handschweißgerätes (100), das dafür konfiguriert ist, einen Schweißdraht (136) zu einem Schweißbrenner (130) zuzuführen, wobei der Schweißbrenner (130) einen Auslöser (134) und eine Öffnung aufweist, wobei der Schweißdraht (136) vorangeschoben wird, wenn der Auslöser (134) aktiviert wird;

Bereitstellen eines Computers mit einer Benutzerschnittstelle (126), der ein automatisches Drahtrückziehprogramm enthält, mit dem sich kein Schweißdraht (136) aus der Öffnung des Schweißbrenners (130) erstreckt;

Überwachen des Schweißbrenners (130);

Bestimmen, wann der Auslöser (134) deaktiviert wird;

Konfigurieren des automatischen Drahtrückziehprogramms, um anzuzeigen, wann eine erste Bedingung erfüllt ist; und

Zurückziehen des Schweißdrahtes (134), dergestalt, dass der Schweißdraht (134) nicht aus der Öffnung des Schweißbrenners (130) hervorsteht.

10. Verfahren nach Anspruch 9, wobei die erste Bedingung eine Rückziehverzögerungszeit ist.

11. Verfahren nach einem der Ansprüche 7 bis 10, das des Weiteren ein Mittel zum Bestimmen eines ersten

Zeitbetrages umfasst, wann der Auslöser (134) deaktiviert wird, oder das Bestimmen eines ersten Zeitbetrages enthält, wann der Auslöser (134) deaktiviert wird, und des Weiteren das Bestimmen enthält, wann der erste Zeitbetrag mindestens gleich der Rückziehverzögerungszeit ist.

12. Verfahren nach einem der Ansprüche 7 bis 11, das des Weiteren umfasst, die Benutzerschnittstelle (126) so zu konfigurieren, dass sie die Rückziehverzögerungszeit und eine Rückzugszeit oder eine Rückzugsdistanz enthält.

13. Verfahren nach einem der Ansprüche 7 bis 12, das des Weiteren mindestens einen Sensor (148) umfasst, sowie das Konfigurieren der Benutzerschnittstelle (126) dergestalt, dass sie die Rückziehverzögerungszeit und einen Sensorparameter enthält, wobei der mindestens eine Sensor (148) dafür konfiguriert ist, ein Ende des Schweißdrahtes anzuzeigen, wobei der Sensorparameter und der Rückzugsschritt dafür konfiguriert sind anzugeben, wann der Rückzugsschritt anzuhalten ist.

14. Verfahren nach einem der Ansprüche 1 bis 13, wobei die Öffnung des Schweißbrenners (130) eine Düse (140) umfasst, die ein Düsenende (140a) und eine Spitze (144) aufweist, wobei sich der Schweißdraht (136) zum Ende des Rückzugsschritts in die Spitze (144) zurückzieht, oder wobei sich der Schweißdraht (136) zum Ende (144) des Rückzugsschritts nicht über das Düsenende (140a) hinaus erstreckt.

15. Verfahren nach einem der Ansprüche 1 bis 14, wobei die Öffnung des Schweißbrenners (130) eine Spitze (144) umfasst, wobei sich der Schweißdraht (136) zum Ende des Rückzugsschritts in die Spitze (144) zurückzieht, oder wobei sich der Schweißdraht zum Ende des Rückzugsschritts nicht über das Düsenende hinaus erstreckt.

Revendications

1. Procédé de retrait de fil automatique pour un appareil de soudage manuel, comprenant :

la fourniture d'un appareil de soudage manuel (100) ayant au moins une source de puissance de soudage (102), un dispositif d'alimentation de fil (104) configuré pour fournir un fil de soudage (136), et un pistolet de soudage (130) comportant une gâchette (134) et une ouverture de laquelle le fil de soudage (136) s'étend ;
la fourniture d'un programme de retrait de fil automatique ayant une temporisation de retrait ;
la configuration de l'appareil de soudage manuel (100) pour inclure le programme de retrait de fil automatique ;
la surveillance du moment auquel la gâchette (134) est activée pour déployer le fil de soudage (136) du dispositif d'alimentation de fil (104) à l'ouverture, et le déploiement du fil de soudage (136) hors de l'ouverture du pistolet de soudage (120) ;
la détermination d'une première quantité de temps auquel la gâchette (134) est désactivé ;
la détermination du moment auquel la première quantité de temps est au moins égale à la temporisation de retrait, dans lequel la gâchette (134) est désactivée au cours de la première quantité de temps ; et
le retrait du fil de soudage (136) dans l'ouverture du pistolet de soudage (130) de sorte que le fil de soudage (136) ne se déploie pas à partir de l'ouverture du pistolet de soudage (130).

2. Procédé selon la revendication 1, dans lequel le retrait du fil de soudage (136) dans l'ouverture du pistolet de soudage (130) est configuré pour durer pendant un temps de retrait ; dans lequel le temps de retrait est configuré dans le programme de retrait de fil automatique.

3. Procédé selon la revendication 1, dans lequel le retrait du fil de soudage (136) dans l'ouverture du pistolet de soudage (130) est configuré pour se dérouler sur une distance de retrait ; dans lequel la distance de retrait est configurée dans le programme de retrait de fil automatique.

4. Procédé selon l'une quelconque des revendications 1 à 3, dans lequel le pistolet de soudage (130) comprend en outre au moins un capteur (148) configuré pour indiquer une extrémité du fil de soudage (136), dans lequel un paramètre de capteur et l'étape de retrait sont configurés pour déterminer le moment auquel l'étape de retrait est terminée.

5. Procédé selon l'une quelconque des revendications 1 à 4, dans lequel le dispositif d'alimentation de fil (104) comprend en outre une interface utilisateur (136) configurée pour régler la temporisation de retrait et au moins l'un de ce qui suit : un temps de retrait, une distance de retrait et un paramètre de capteur.

6. Procédé selon l'une quelconque des revendications 1 à 5, dans lequel le programme de retrait de fil automatique est configuré pour inclure un programme de mot de passe pour permettre l'ajustement d'au moins l'un de ce qui suit : la temporisation de retrait, un temps de retrait, une distance de retrait, et un paramètre de capteur.

7. Procédé comprenant :

la localisation d'un appareil de soudage manuel (100) comportant un pistolet de soudage (130) et une ouverture, qui ne comprend pas de programme de retrait de fil automatique, par lequel un fil de soudage (136) ne se déploie pas à partir de l'ouverture du pistolet de soudage (130),
la modification de l'appareil de soudage manuel (100) de sorte qu'il comprenne le programme de retrait de fil automatique ; et
l'activation du programme de retrait de fil automatique.

8. Procédé selon la revendication 7, comprenant en outre des moyens de retrait d'un fil de soudage.

9. Procédé comprenant :

la fourniture d'un appareil de soudage manuel (100) configuré pour fournir un fil de soudage (136) à un pistolet de soudage (130), dans lequel le pistolet de soudage (130) comporte une gâchette (134) et une ouverture dans laquelle le fil de soudage (136) se déploie lorsque la gâchette (134) est activée ;
la fourniture d'un ordinateur avec une interface utilisateur (126) qui comprend un programme de retrait de fil automatique, par lequel un fil de soudage (136) ne se déploie pas à partir de l'ouverture du pistolet de soudage (130) ;
la surveillance du pistolet de soudage (130) ;
la détermination du moment auquel la gâchette (134) est désactivée ;
la configuration du programme de retrait de fil automatique pour indiquer le moment auquel une première condition est remplie ; et
le retrait du fil de soudage (134) de sorte que le fil de soudage (134) ne se déploie pas à partir de l'ouverture du pistolet de soudage (130).

10. Procédé selon la revendication 9, dans lequel la première condition est une temporisation de retrait.

11. Procédé selon l'une quelconque des revendications 7 à 10, comprenant en outre des moyens de détermination d'une première quantité de temps pendant laquelle la gâchette (134) est désactivée ou comprenant la détermination d'une première quantité de temps pendant laquelle la gâchette (134) est désactivée, et en outre la détermination du moment auquel la première quantité de temps est au moins égale à la temporisation de retrait.

12. Procédé selon l'une quelconque des revendications 7 à 11, comprenant en outre la configuration de l'interface utilisateur (126) pour inclure la temporisation de retrait et un temps de retrait ou une distance de retrait.

13. Procédé selon l'une quelconque des revendications 7 à 12, comprenant en outre au moins un capteur (148) et la configuration de l'interface utilisateur (126) pour inclure la temporisation de retrait et un paramètre de capteur, dans lequel l'au moins un capteur (148) est configuré pour indiquer une extrémité du fil de soudage, dans lequel le paramètre de capteur et l'étape de retrait sont configurés pour indiquer le moment auquel arrêter l'étape de retrait.

14. Procédé selon l'une quelconque des revendications 1 à 13, dans lequel l'ouverture du pistolet de soudage (130) comprend une buse (140) ayant une extrémité de buse (140a) et un embout (144), dans lequel le fil de soudage (136) se retire à l'intérieur de l'embout (144) à la fin de l'étape de retrait ou dans lequel le fil de soudage (136) ne se déploie pas au-delà de l'extrémité de buse (144a) à la fin (144) de l'étape de retrait.

15. Procédé selon l'une quelconque des revendications 1 à 14, dans lequel l'ouverture du pistolet de soudage (130) comprend un embout (144), dans lequel le fil de soudage (136) se retire à l'intérieur de l'embout (144) à la fin de l'étape de retrait, ou dans lequel le fil de soudage ne s'étend pas au-delà de l'embout à la fin de l'étape de retrait.

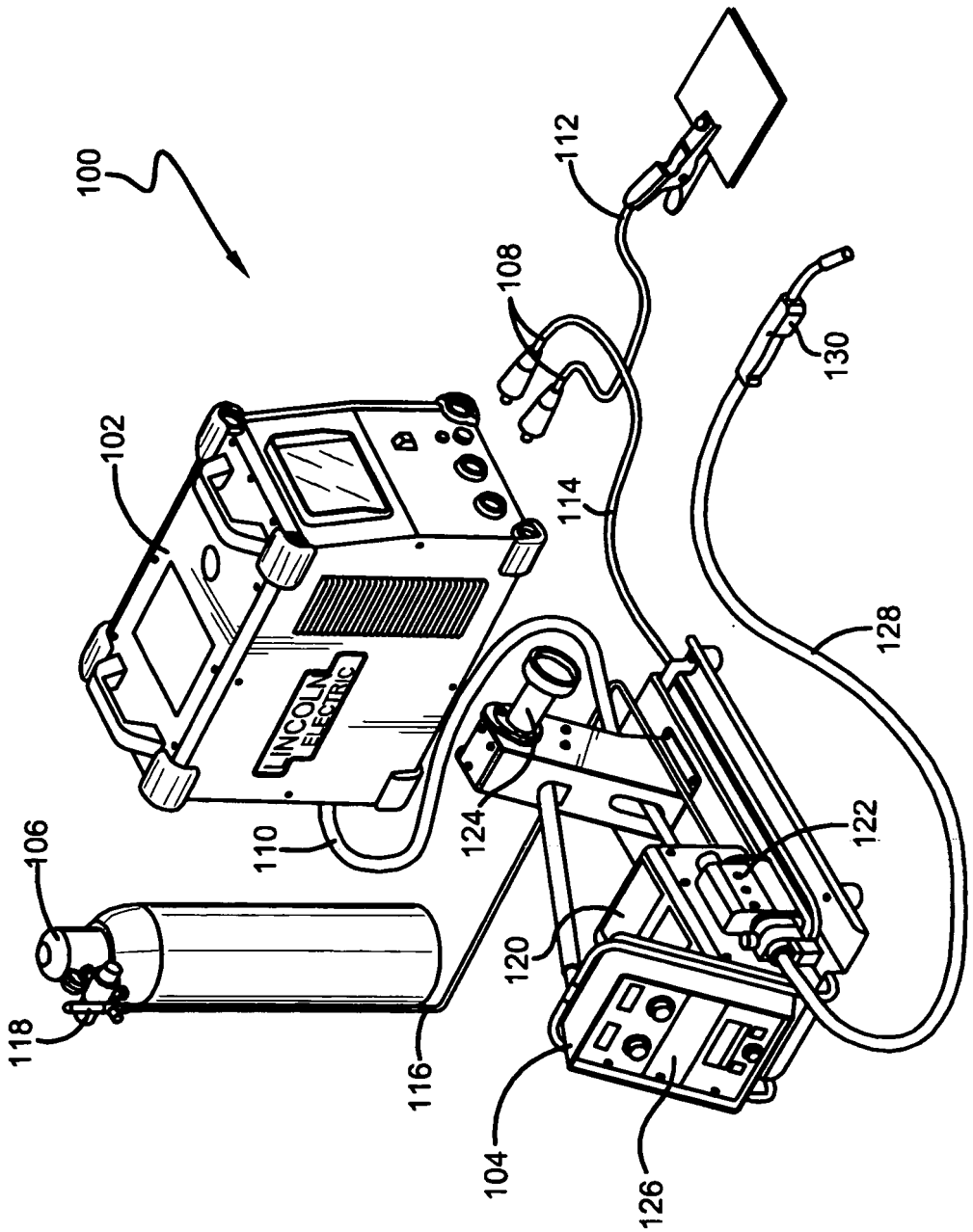

100
102
104
106
108
110
112
114
116
118
120
122
124
126
128
130
LINCOLN ELECTRIC

FIG. 1

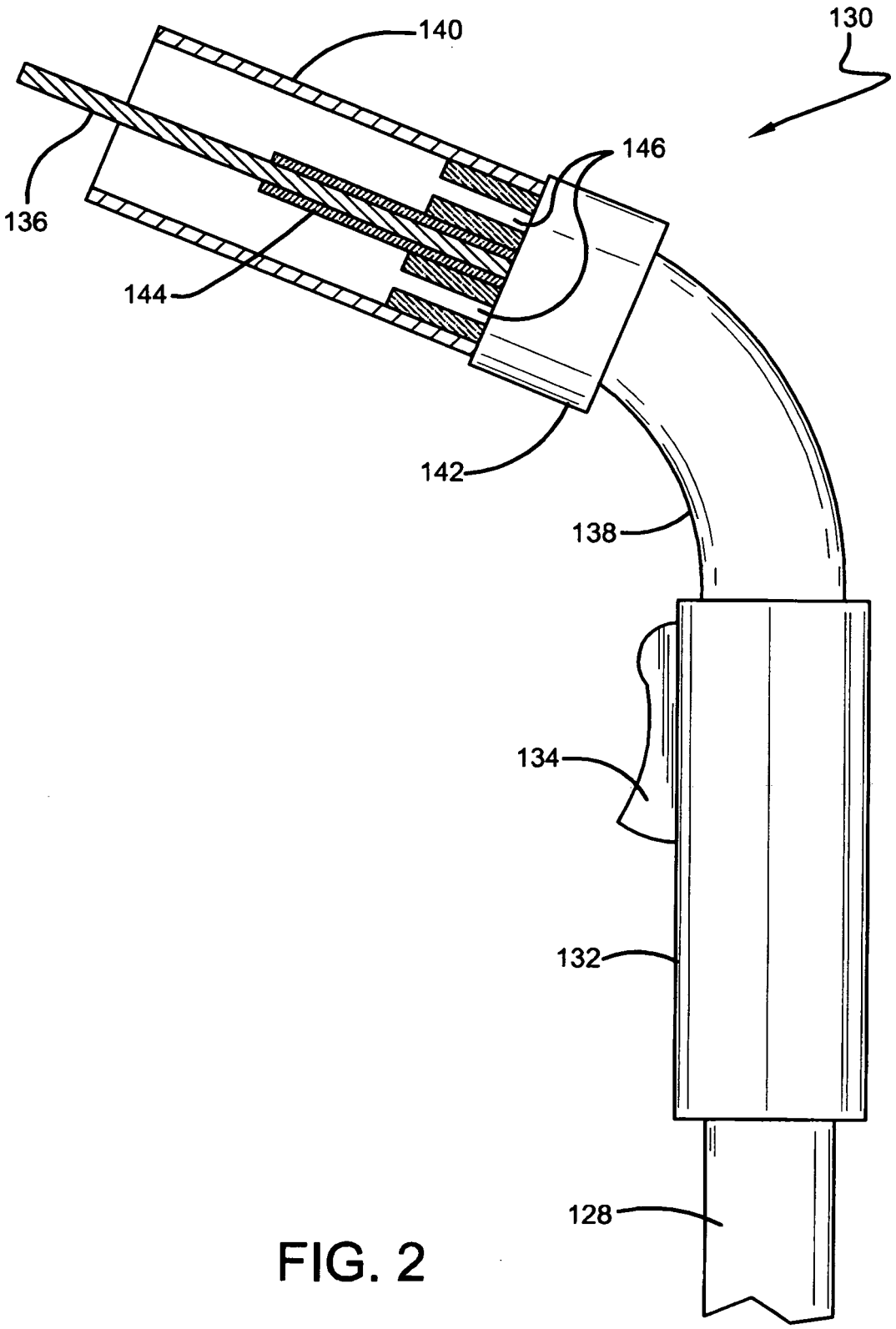


FIG. 2

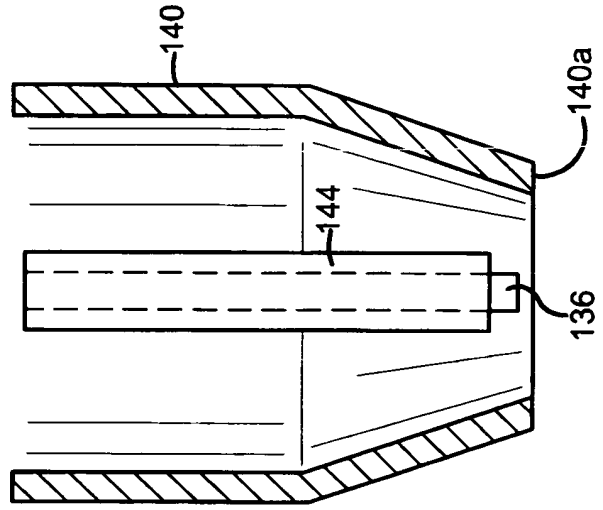


FIG. 3C

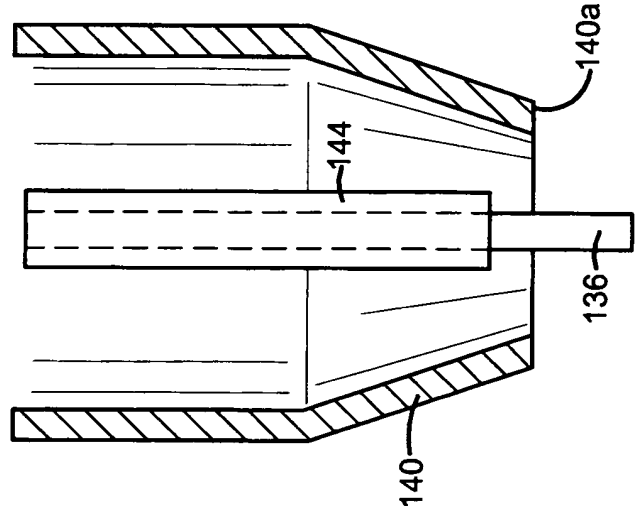


FIG. 3B

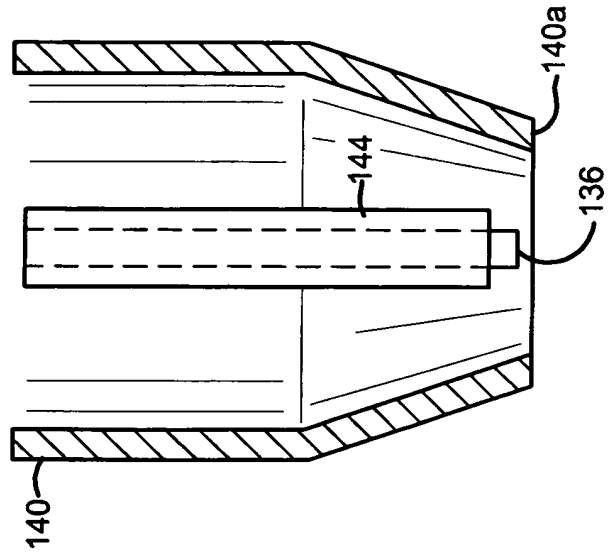


FIG. 3A

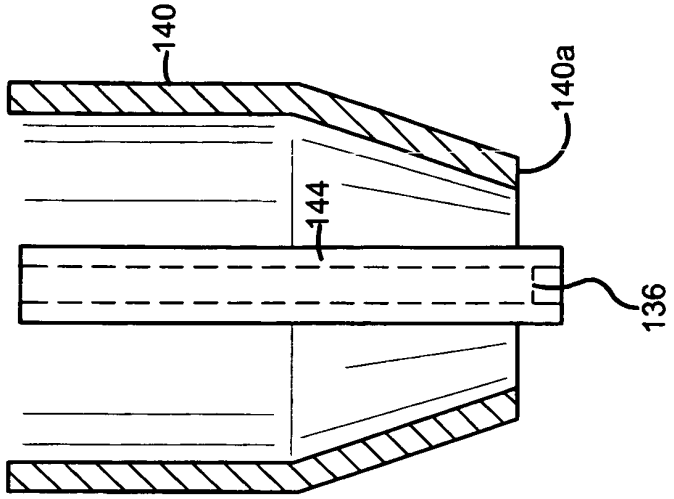


FIG. 4C

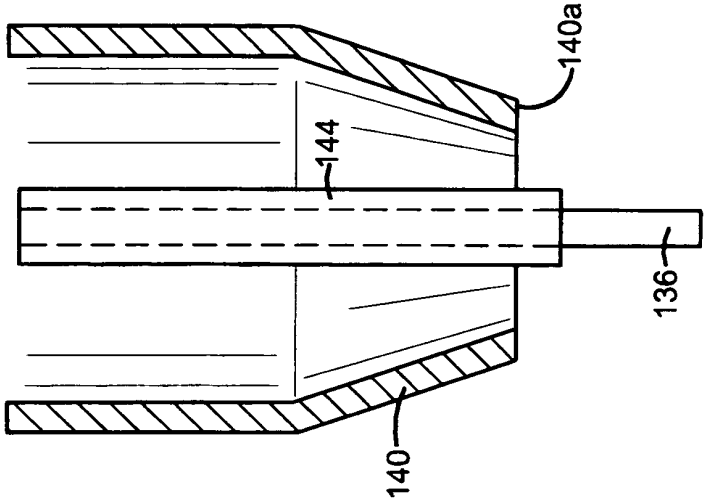


FIG. 4B

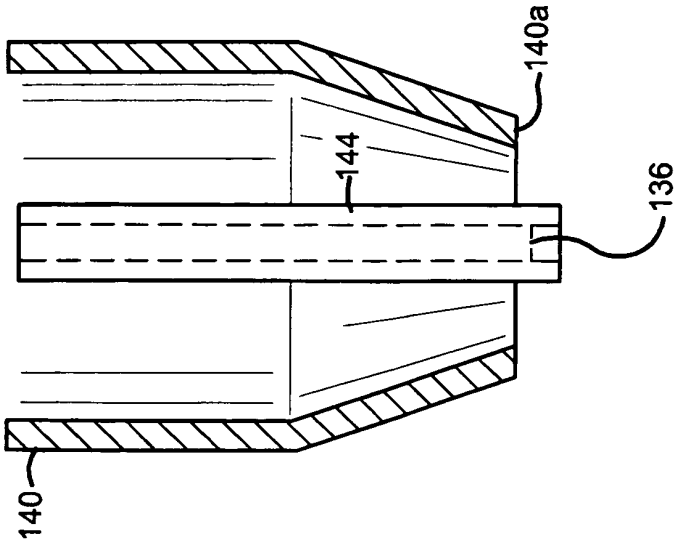


FIG. 4A

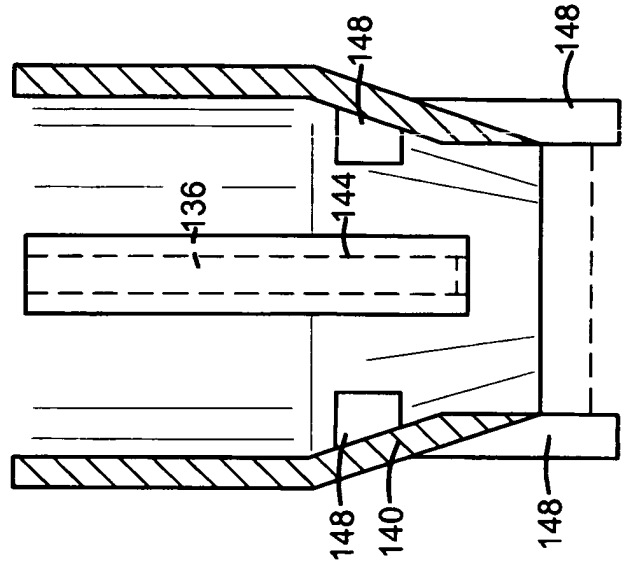


FIG. 5C

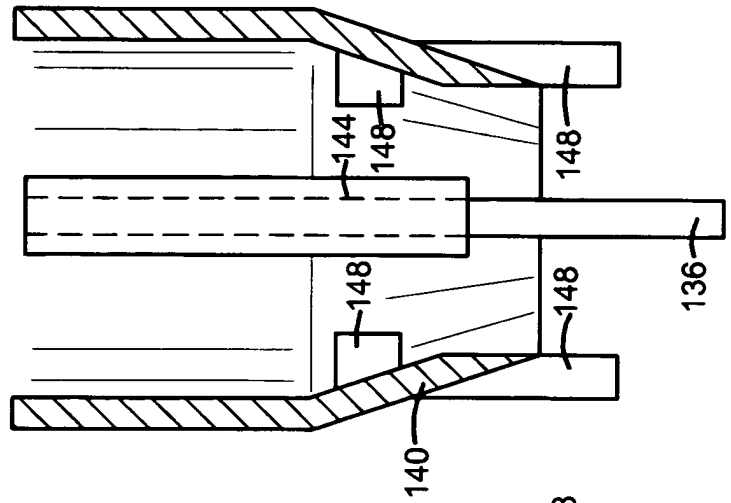


FIG. 5B

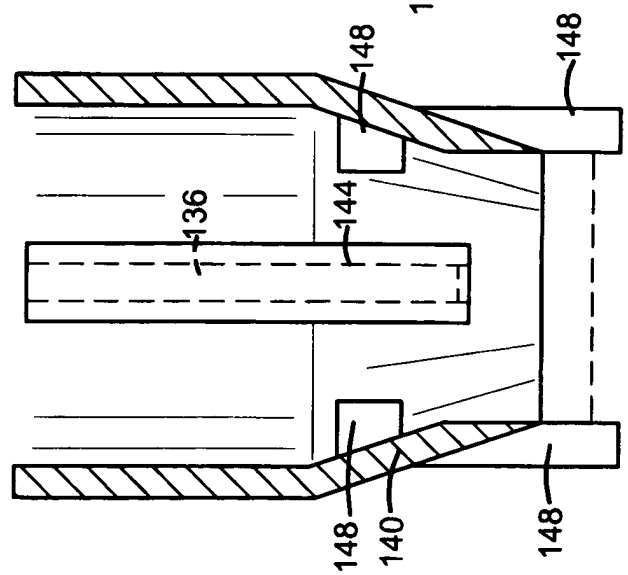


FIG. 5A

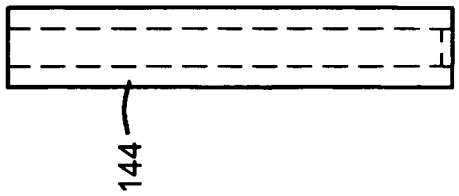


FIG. 6C

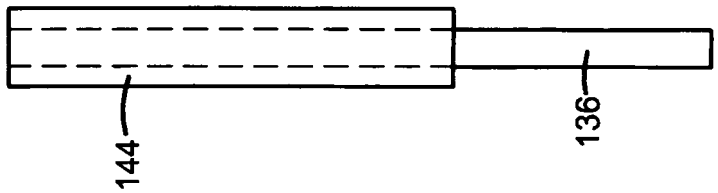


FIG. 6B

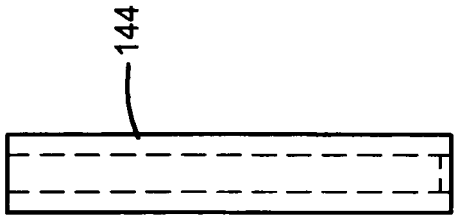


FIG. 6A

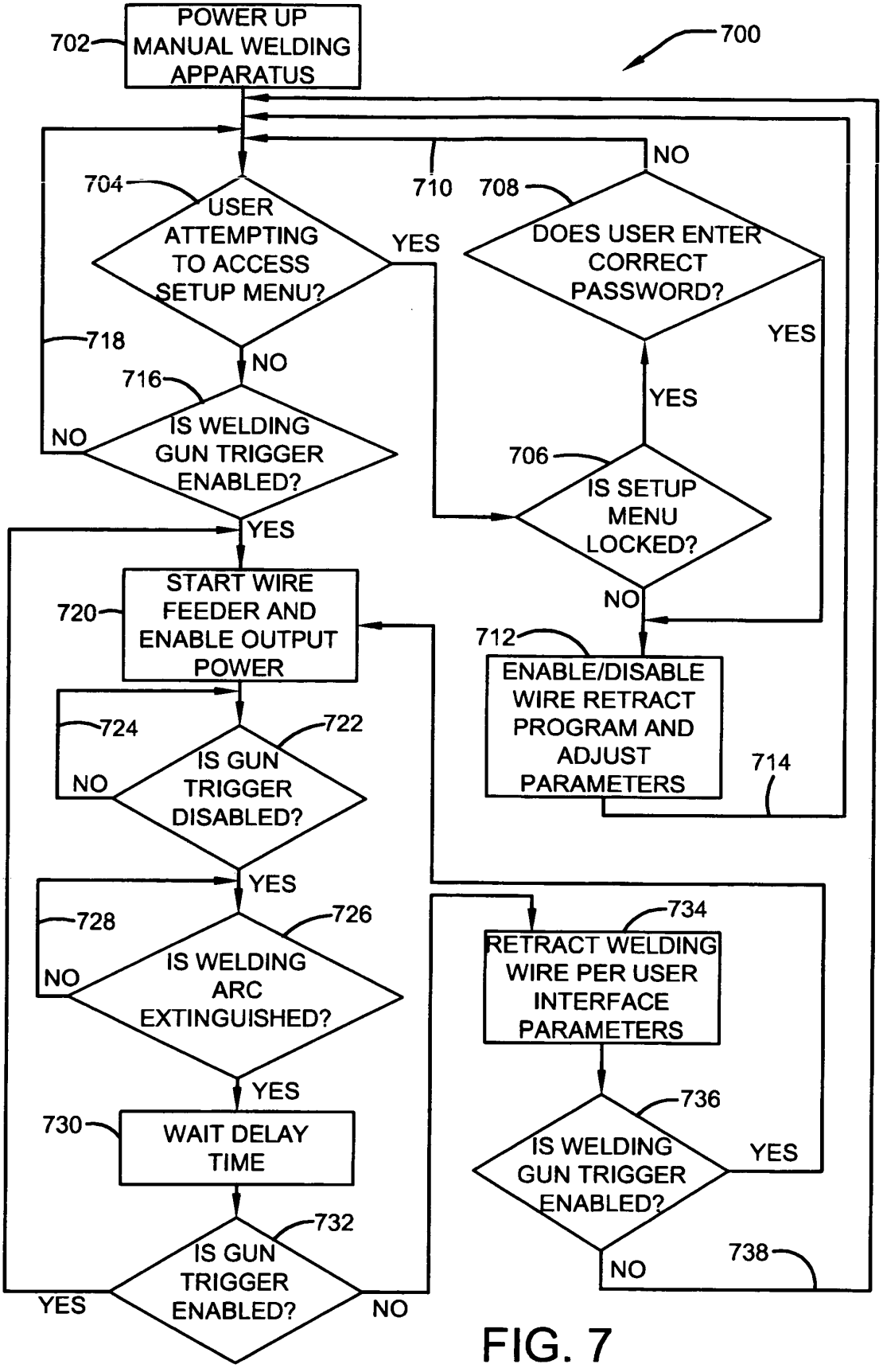

POWER UP MANUAL WELDING APPARATUS
702
700
704
USER ATTEMPTING TO ACCESS SETUP MENU?
YES
NO
710
708
DOES USER ENTER CORRECT PASSWORD?
YES
NO
718
716
IS WELDING GUN TRIGGER ENABLED?
NO
YES
706
IS SETUP MENU LOCKED?
YES
NO
720
START WIRE FEEDER AND ENABLE OUTPUT POWER
712
ENABLE/DISABLE WIRE RETRACT PROGRAM AND ADJUST PARAMETERS
714
724
722
IS GUN TRIGGER DISABLED?
NO
YES
728
726
IS WELDING ARC EXTINGUISHED?
NO
YES
730
WAIT DELAY TIME
732
IS GUN TRIGGER ENABLED?
YES
NO
734
RETRACT WELDING WIRE PER USER INTERFACE PARAMETERS
736
IS WELDING GUN TRIGGER ENABLED?
YES
NO
738

FIG. 7

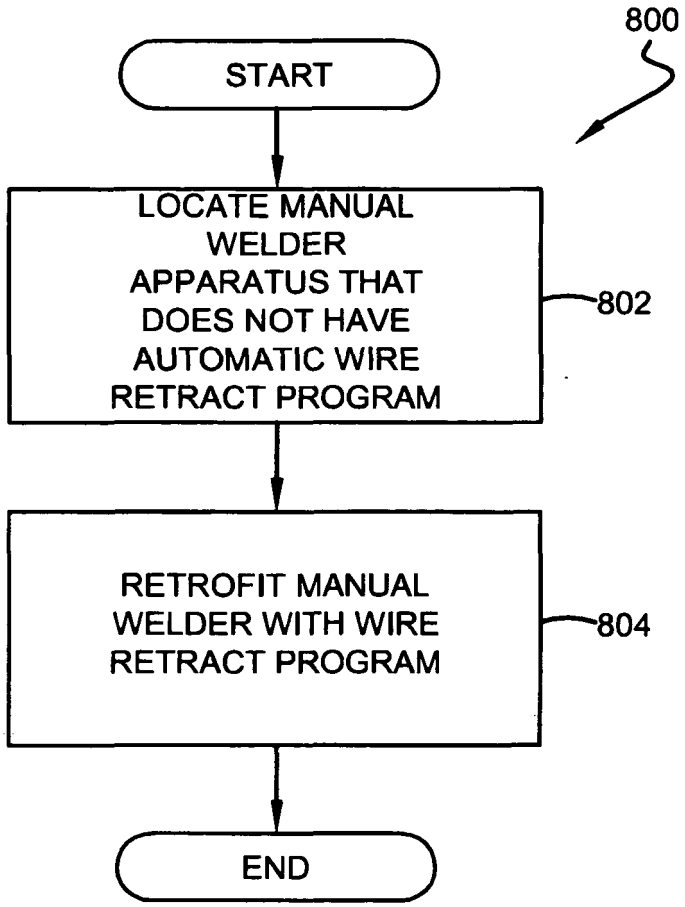

800
START
LOCATE MANUAL WELDER APPARATUS THAT DOES NOT HAVE AUTOMATIC WIRE RETRACT PROGRAM
802
RETROFIT MANUAL WELDER WITH WIRE RETRACT PROGRAM
804
END

FIG. 8

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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